Heavy Ion Morning Numbers Documentation

Introduction:

This help page should be used as a guideline for Heavy Ion Morning Numbers documentation. Keep in mind that parameters of the machine are constantly changing. These changes could have a significant impact on the method used in calculating values. It can be helpful to ask the OC, liaison physicists or group leaders about data taking methods, especially if aspects of the machine have been changed.

In addition to the Morning Numbers Form, a new LabVIEW program has been implemented to file the data electronically. The Morning Numbers program is similar to the paper version in most aspects. You can find the program by clicking in the background of an MCR terminal. Under the Coordinator's Logs menu, choose Morning Numbers, then Heavy Ions. Areas where data input is different will be noted in **MornNum NOTES** sprinkled throughout this procedure.

MornNum Note: It is important to always click the **<Submit>** button when using the MornNum program. Simply clicking the **<Quit>** button will erase all data acquired. When starting the program, make sure you start with the **<General Information>** menu, providing your initials (3 characters, please), Today's Date/Time using proper format, i.e. Feb 24 2000 6:00 AM and the Experiment, i.e. RHIC – Gold.

1. TTB Beam Current

1.1 Trigger the scope with **TT_BEAM_ON**, making sure the machine, user, and cycle are set appropriately (i.e. Booster, user 1, cycle 2). Using Xbar, put the following signals on the scope:

Booster/Monitor: Current Transformers/**BXI.INJ.XFMR**
Tandem/Current Transformers/**TXI.SEC29_XF.104FT**
Booster/Power Supplies: Injection/**BXI.KDHC1** (or any other Booster injection kicker signal)

1.1.1 Stop the scope acquisition and print the display with the *Screendump* application onto the Morning Numbers form.

NOTE: If you use the main paper tray of the printer, insert the form face down with the header pointing toward the front of the printer.

MornNum NOTE: As of 5/2/00, there is no way to input the scope graphics into the program. Steps that ask for screendumps or other graphics can be omitted.

1.1.2 Record the ion species and charge state of the particles being accelerated (i.e. Fe 10^+, Au 32^+, Au 31^+).

1.1.3 The Revolution Period is determined by the species being accelerated. As of Oct 22, 1996, these values are:

Species	**Revolution Period**
Fe 10+	9.6 μs
Au 32+	15.1 μs
Au 31+	15.1 μs

1.1.4 The Width (μs) is measured from Section 29 IXFMR; Full Width at Half Maximum (FWHM)

1.1.5 The injection Current (μA) is measured from the average height of the Section 29 IXFMR. The calibration can be found on the information pop-up screen for the device

and will depend on the current setting for the current transformer gain (As of 7/23/99, we are using high gain and a calibration of 1V = 100 μA). The gain setting can be found on Spreadsheet at *Booster/Injection/TTB/C_section290*/**BLI.XF.GN**.

1.1.6 Turn on calibration pulse for the Booster Injection IXFMR at ~2800 μs. The calibration pulse can be found at *Spreadsheet/Booster/Other/Morning Numbers*/**BTG.BCBM_CAL.RT**. The pulse is 500μA.

1.1.6.1 To determine the IXFMR current at a particular time, measure the voltages of the calibration pulse and the IXFMR.

1.1.6.2 For Circulating Current, solve the equation:

Circulating Current = 500 μA * (V of Circulation portion / V of Calibration portion)

1.1.6.3 Perform this calculation using the voltage measured at TTBeam (Current at top of stack) and TTBeam + 2.5ms.

MornNum NOTE: **Total Current Available** and **Efficiency** are automatically calculated by clicking on the <**Calculate**> button after all other information has been entered.

1.1.7 Calculate the Total Current Available with the following equation:

Total Current = (Width / Revolution Period) * Current (μA)

1.1.8 Determine Efficiency with the equation:

Efficiency = (Current at TTBeam + 2.5 ms) / (Total Current Available) * 100

2. TTB Element Setpoints

2.1 Open *Spreadsheet Tandem/Sec29* or *Booster Injection/TTB*

2.2 Copy down the setpoints of the devices listed onto the Morning Numbers Form.

MornNum NOTE: All of the values of the devices for this section are automatically recorded EXCEPT for **PEAKER.GT** and **PSEUDO_PEAKER.RT**.

3. TTB Multiwires and BTA Multiwires

MornNum NOTE: ALL multiwires are grouped into the **Multiwire** menu. When this menu is opened, there are three files for each group of multiwires: TTB, BTA and AGS. As of 2/24/00, the AGS multiwire data is not needed. This may change in the near future.

3.1 Open the *BeamLineInstrument* application, found in *StartUp/start/General Applications/BeamLineInstrument.*

3.2 Under the Setup menu, select TTB or BTA multiwires and then the specific multiwire needed.

3.3 Check to be sure that the cycles preset for each multiwire has beam (use *Superman* or comfort displays to see which cycles have beam).

NOTE: Call Tandem X4584 before inserting 11MW030.

3.4 Click the <Acquire Once> button.

3.5 Record the data for each listed multiwire. Make printouts of the last four TTB Multiwires and include them in the Morning Numbers Form.

NOTE: Keep in mind while documenting BTA multiwires that the *BeamLineInstrument* program is not infinitely flexible when calculating the mean and FWHM numbers. Since stripping foils are not 100% effective, you will find that beam of several charge states exist within the beam pipe in some areas. In BTA, you can see multiple "bumps" on some of the horizontal beam profiles.. The application will most likely miscalculate its output when you acquire data. Instead of believing the computed values, you should simply read them off the profile graph. Incidentally, without the BTA Collimator in the beam (its normal state), the vertical numbers are also wrong since they include all of the charge states (the beam isn't bent much vertically).

4. Foil Thickness

4.1 Call the Tandem operator X4584 and ask for the current Object Foil Thickness and Terminal Foil Thickness (along with its units). Enter these on the Morning Numbers Form.

5. Booster Extraction Field Bdot

5.1 Locate the counters on the right side of each console (**EXCEPT MCR5**).

5.1.1 Connect the scalar start and reset signals to Scope Trig #3.

5.1.2 Connect the scalar stop signal to Scope Trig #4.

5.2 Open Xbar

5.2.1 Set Trigger 3

Trigger: 3
Status: ON
Start: *Booster*/**B.XTRCN_ST.GT**
Machine: Booster
User: Use Appropriate user
Cycle: Use appropriate cycle
Delays: OFF

5.2.2 Set Trigger 4

Trigger: 4
Status: ON
Start: *Booster*/**B.XTRCN_ST.GT**
Machine: Booster
User: Use Appropriate user (same as Trigger 3)
Cycle: Use appropriate cycle (same as Trigger 3)
Delays: **BGN.MEGA.HZ.BTO.CK** + 5000 usec

5.3 Record the "Booster Up Counts" scalar.

6. Extraction Bumps

6.1 Open *BoosterOrbitControl* from *StartUp/start/Booster Applications.*

6.2 Under the Setup menu, choose *Process/Orbit Bumps/ Extraction Slow 4 Bump*.

6.3 At the first prompt, enter the Booster extraction time from T0 in ms (this can be checked by measuring the time between T0 and when the extraction equipment comes on).

6.4 At the second prompt, click <OK> when asked for the B field.

6.5 At the third prompt, click <Yes> when asked if you want to use these tune values.

6.6 At the fourth prompt, change the polarities of the bump to be BABA by double clicking on the first and third lines (**BMM.TDHF2.SPRB** and **BMM.TDHF7.SPRB** should both be "B(inward ; negative)". Click on <Continue – settings are correct> when done. **DO NOT CLICK ON <OK>.**

6.7 Under the Bump Options menu, click on <Readback>

6.8 Inhibit the Booster RF

6.9 Click on <measurement readback>.

6.10 After data is taken, uninhibit Booster RF.

6.11 Record the data given onto the Morning Numbers Form.

7. Scalars

7.1 Open the *GPM* under *StartUp/start/General Applications*.

7.1.1 Open the GPM file called **Scratch/MornNumb.mon**.

7.1.2 Wait for a few AGS beam cycles to pass

7.1.3 From the Setup menu, click on <Stop Monitoring>.

7.1.4 Record the scalars onto the Morning Numbers Form.

MornNum NOTE: Scalars are automatically attained when the program is first opened. In the case of a bad shot or no shot when the program was opened, the **<Update SCALARS>** button can be used to attain a new set of scalars.

8. AGS Extraction: RHIC Matching

8.1 Connect external arm signal of Hewlett Packard frequency analyzer at MCR3-1 to channel 9. Connect channel A to the AGS RF sweep signal.

8.2 Select the Function menu on the scope.

8.2.1 Change the FUNCTION to *Frequency*.

8.2.2 Change the Arming Mode to *Edge/Interval*.

8.2.3 Change Sample Arm to 10ms intervals.

8.3 Open Xbar. Setup Trigger 9 as follows:

Trigger: 9
Status: ON
Start: **A.T_ZERO.SU**
Machine: AGS
User: use appropriate user
Cycle: use appropriate cycle
Delay 1: ON
Delay Clocks: **AGN.KILO.HZ.ATO.CK**
Count: (Use F3 A5 trigger time from *Spreadsheet/Feb/Extraction/Cld*).
Units: usec

8.4 On the HP frequency analyzer, press the Numeric button to display the measured frequency. Record the Extraction Frequency in megahertz and include digits down to hertz.

8.5 For **Injection Frequency**, set Trigger 9 to the following settings:

Trigger: 9
Status: ON
Start: *Booster*/**B.F3_A5_trigger**
Machine: Booster
User: use appropriate user
Cycle: use appropriate cycle
Delays: OFF
Delay Clocks: OFF

8.6 On the HP frequency analyzer, press the *Numeric* button to display the measured frequency. Record the **Injection Frequency** in megahertz and include digits down to hertz.

9. AGS Gauss Clock Counts

9.1 Locate the counters on the right side of each console (EXCEPT MCR5).

9.1.1 Connect the scalar start and reset signals to Scope Trig #3

9.1.2 Connect the scalar stop signal to Scope Trig #4

9.2 Open Xbar and set the following triggers:

Trigger: 3
Status: ON
Start: *AGS*/**A.T_ZERO.SU**
Machine: AGS
User: use appropriate user
Cycle: 1
Delays: OFF

Trigger: 4
Status: ON
Start: *FEB*/**F.FEBbunch**
Machine: AGS
User: use appropriate user (same as Trigger 3)
Cycle: 1
Delays: OFF

9.3 Record the “AGS Up and Down Counts” scalar from their displays.

NOTE: When using FEB Bunch, stop triggers will only be received on RHIC injection.

10. AGS Hall Probes

10.1 Open *Vbar* under *StartUp/start/General Programs/Vbar*

10.1.1 Select **AVI.MMPS_HALL_V_FLD** under the heading *Computer_generated_video*.

11.1.2 Record the field at T0 and at each delay listed in **AVI.MMPS_HALL_V_FLD**.

11. Measure AGS Radius at Extraction

11.1 Open *AGSOrbitDisplay* from *StartUp/start/AGS Applications/AGSOrbitDisplay*. The default variables should be sufficient.

11.2 Change the Scantimes to appropriate values

11.2.1 Set one entry to be the equivalent delay of FEB Request (*Spreadsheet/Feb/Extraction/CLD*).

11.2.2 Set one entry to the time the extraction equipment kicks the beam.

NOTE: As of 8/6/99, FEB Request is at 2200 ms, and extraction occurs at 2230 ms.

11.3 Select *Setup/Set Report Type/Generate Fresh Report*.

11.4 Click on <Acquire Once> from the Data menu.

11.5 Make a hard copy of the plot and add to the Morning Numbers Data.

MornNum NOTE: Because this is a graphic request, it can be omitted from electronic data acquisition steps.